Topics from the 2016 Chamonix Workshop with relevance for the HL-LHC project

G. Arduini, O. Brüning, Y. Papaphilippou, L. Rossi,
S. Redaelli, G. Vandoni, J. Wenninger, M. Zerlauth

2nd HL-LHC TCC, February 11, 2016

Chamonix Sessions

Monday:

Session 1 - Lessons from 2015 Operations

(operations, efficiency, MPT, Coll, RF& ADT, circuits)

Session 2 - Key Challenges for Operation

(UFOs, ULO, BLMs, e-cloud, Z heating & instabilities, SPS, BI)

Tuesday:

Session 3 - LHC Hardware Performance

(Fault tracking, availability, Cryo, QPS, circuits, PC)

Session 4 - LHC Hardware Performance

(LBDS, RF& ADT, BI, Tech Infra, R2E, ➔ 7 TeV)

Wednesday:

Session 5 - 2016 and Run 2

(YETS recovery, Exp expect, β^*, injectors, ion run, MDs, plans)

Session 6 - LIU

Thursday:

Session 7 – HL-LHC

Session 8 – LS2

Friday:

C-MAC closeout

Chamonix 2016: Monday Sessions

2015 operation and challenges:

- ε growth: non-colliding bunches close to preservation / colliding bunches show large scatter around ≈ 15%/h @ FT
- 2% beam loss during cycle (1%) ➔ up to 10 MJ for HL-LHC
- 33% of time in Stable Beam after TS2 (need ≈ 40%)
- Only ⅓ of fills terminated by operators (HL-LHC ++) (UFOs!)
- Collimation good and robust
- Quenches: D3 OK @ 6.5 TeV ➔ 7 TeV?
- Quenches: IPQs as above
- Quenches: slower than expected training to 7 TeV wrt SM18
  ➔ expect ca. 1000 training quenches to 7 TeV start of RunI
  ➔ expect now half of that: ca. 500, ⅓ already done!
  ➔ secondary quenches might be higher though
- Different cryo heat load in the LHC sectors: 2 families
- Instabilities: have all diagnostics that is necessary ➔ WBFB?

Chamonix 2016: Tuesday & Wednesday

Tuesday - Hardware Performance:

- Fault Tracker Tool ➔ Asset for HL-LHC!!!
  ➔ ca. 28fb^{-1} for 2016 and 183 fb^{-1} for HL-LHC with 2015 stats
  ➔ can help in identifying priority for upgrades!
  # Cryo: can one aim for > 93-95% availability
  # QPS ➔ possibility of full redundancy (≈ 5MCHF)

Wednesday - 2016 Goals and Configurations:

- Experiments would like to have ca. 30fb^{-1}
- β^* between 40cm and 50cm with tighter coll and phase adjust
- Heavy Ion physics request not decided
- Operation experience with new TDIS design
- HL-LHC related MD requests:
  -Full RF detuning operation
  -Collimation: halo control, Z, efficiency, quench limits..
  -ATS commissioning (2 and single IR squeezed)
  -ξ = 0.03 measured in MDs (0.04 with noise and bad lifetime)

Chamonix 2016: Thursday Sessions

HL-LHC @ Chamonix:

- E-cloud heat load ≈ constant for above nominal intensities
  ➔ HL-LHC is OK if LHC can be conditioned to nominal
- Need to decide on in-situ triplet (IPQ) coating [aC or laser]
- RF Coupler lifetime of ca. 15y ➔ impact for HL-LHC?
- 200MHz sub harmonic RF system
  ➔ when and based on what should we take a decision?
  ➔ observation that LIU could meet HL-LHC parameters with longer bunches [presentation by Brennan]
- SPS Crab Cavity tests: tight schedule but OK ➔ SM18 ready!!!
- Quench tests in LHC ➔ Collimation Baseline configuration: 11T for P7, empty cryostat coll. For P2; bumps for P1/P5
- Still pending some material/coating choice ➔ need ECRs!
- Vibration studies ➔ interesting summary ➔ feet reinforcement
- Pb ion parameters now 'only' 30-40% short of ALICE needs!
- Crystal collimation feasible for Pb operation?

Chamonix 2016: Friday C-MAC

C-MAC closeout points:

- Congrats to all teams
- 30fb^{-1} requires more time in Stable Beams
  ➔ review number and length of TS
- Estimate sources for ε growth (injection and FT)
- Look into possibility of WBFB for HL-LHC
- Develop further the doublet beams for scrubbing
- Study options and strategy for cryo availability > 98%
- Magnet training campaign should not come before end 2016
- Perform a risk assessment of a training campaign based on experience with one or two sectors
- Difference between LIU and HL-LHC parameters!
- Risk analysis for aging RF components
- Prepare procedures and criteria for how decisions will / should be taken for the various options (e.g. RF, coating etc.)